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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/856,209	05/18/2001	Kozo Nakamura	82822	6736
24628	7590	01/10/2005	EXAMINER	
WELSH & KATZ, LTD 120 S RIVERSIDE PLAZA 22ND FLOOR CHICAGO, IL 60606			SONG, MATTHEW J	
			ART UNIT	PAPER NUMBER
			1765	

DATE MAILED: 01/10/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

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<b>Office Action Summary</b>	<b>Application No.</b> 09/856,209	<b>Applicant(s)</b> NAKAMURA ET AL.	
	<b>Examiner</b> Matthew J Song	<b>Art Unit</b> 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 08 October 2004.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 17-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 17-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>10/8/2004</u> . | 6) <input type="checkbox"/> Other: _____  |

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## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claims 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iida et al (US 5,968,264).

In a method of manufacturing a crystal ingot, note entire reference, Iida teaches a silicon single crystal grown through the use of a crystal pulling apparatus, where wafers were sliced from the thus-obtained silicon ingot (col 14, ln 20-67). Iida also teaches  $(\Delta G = G_e - G_c)$  is not greater than  $5^\circ\text{C}/\text{cm}$ , where  $G_e$  is a temperature gradient at the periphery and  $G_c$  is a temperature gradient at the center portion of a growing crystal (col 10, ln 5-15). Iida also teaches a  $G_e = 30^\circ\text{C}/\text{cm}$  ( $3.0^\circ\text{C}/\text{mm}$ ) and a  $G_c = 35^\circ\text{C}/\text{cm}$  ( $3.5^\circ\text{C}/\text{mm}$ ) (Fig 8), where the  $G_e/G_c$  ratio can be

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determined to be 1.16. Iida also discloses that wafers were sliced from the thus-obtained silicon ingot (col 14, ln 20-67) Iida also teaches an OSF region is observed between a N region, a neutral region having few defects, and a vacancy rich region and interstitial rich region (col 15, ln 1-15 and Fig 10A). Iida also teaches the  $G_c$  is the temperature gradient at a central portion of the growing crystal both in an in-crystal descending zone, 1300-100°C, or in the vicinity of the solid-liquid interface of the crystal, melting point of silicon to 1400°C (col 4, ln 5-15 and col 4, ln 35-39. Iida also teaches an OSF ring with an inner diameter of at least  $\frac{1}{2}$  a wafer inner diameter (Fig 10A) at a pulling speed of 0.62 mm/min. Iida et al also discloses  $G_e$  is the temperature gradient at a peripheral portion of the crystal and  $G_c$  is a temperature gradient at a central portion, where both are in an in-crystal descending temperature zone between 1420°C and 1350°C or between a melting point of silicon and 1400°C in the vicinity of the solid-liquid interface (col 10, ln 1-15), this reads on applicants' temperature region from the solid-liquid interface temperature to approximately 1350°C.

Iida et al does not teach the upper bound of  $1.06 \times (G_{1_{edge}} \times G_{2_{center}})^{-0.2}$ . Iida et al does teach varying the pulling rate between 1.0-0.4 mm/min during growth of a silicon ingot and slicing wafers from the thus obtain ingot (Example 1 and Example 2). Iida et al also shows the OSF ring diameter changes with pulling rate, such that the ratio of OSF ring diameter to crystal diameter is greater than 0.5, note Figure 10A. The range of OSF diameters taught by Iida et al inherently overlaps the range claimed because the upper bound is greater than 0.5 and Iida et al discloses ratios of OSF ring diameter to crystal diameter from 0.5 to about 1. Overlapping ranges are held to be obvious (MPEP 2144.05).

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Referring to claim 17, Iida et al is silent to the GOIC of the silicon ingot. However, Iida et al teaches a method of producing a silicon ingot comprising a similar process of pulling the ingot, as applicant. Therefore, the ingot inherently will have a GOIC with the claimed range because a similar process is expected to produce a product with similar properties.

### *Response to Arguments*

3. Applicant's arguments, see page 4 of the remarks, filed 10/8/2004, with respect to Iida et al have been fully considered and are persuasive. The rejection of claim 17 and 18 has been withdrawn. Iida et al does not teach  $G2_{center}$  since  $G1_{center}$  is not equivalent to  $G2_{center}$ .

4. Applicant's arguments with respect to claims 17-20 have been considered but are moot in view of the new ground(s) of rejection.

5. Applicant's arguments filed 10/8/2004 have been fully considered but they are not persuasive.

Applicants' argument that Iida et al does not teach the upper limit of  $1.06 \times (G1_{center} \times G2_{center})^{-0.02}$  is noted but is not found persuasive. Applicants' allege that Iida et al does not teach  $G2_{center}$ , which the Examiner agrees. However, Iida et al teaches varying the pulling during growth, which changes the diameter of the OSF ring during growth (Fig 10A). The cross section of the ingot showing the OSF ring taught by Iida encompasses many ratios of OSF ring diameter to crystal diameter, including ratios greater than 0.5. Therefore, Iida et al teaches a range of

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ratios, which inherently overlap the claimed range since the claimed upper bound must be greater than 0.5. Overlapping range are held to be obvious (MPEP 2144.05).

### ***Conclusion***

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Park et al (US 6,472,040) teaches pulling a silicon ingot to from a vacancy rich region (col 3, ln 35-45) and varying pulling rate between 1.2 mm/min and 0.4 mm/min to determine a preferred pulling rate (col 10, ln 10-25).

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

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8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song  
Examiner  
Art Unit 1765

MJS  
January 4, 2005

NADINE G. NORTON  
SUPERVISORY PATENT EXAMINER  
